WATER RESOURCES REVIEW for

MAY

1976

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

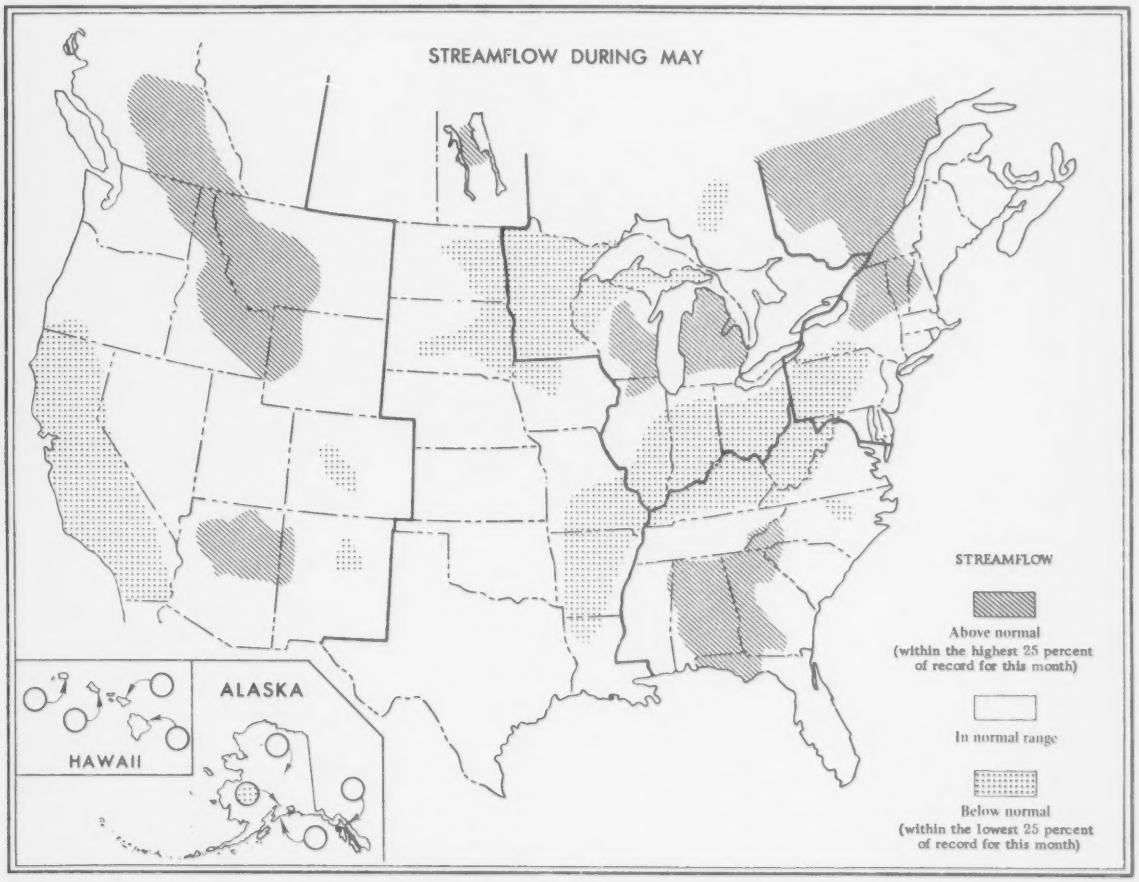
CANADA
DEPARTMENT OF THE ENVIRONMENT
WATER RESOURCES BRANCH

STREAMFLOW AND GROUND–WATER CONDITIONS

Streamflow generally decreased seasonally except in western areas and parts of southern Canada experiencing continued snowmelt runoff from higher elevations and in some areas having above normal rainfall such as parts of Georgia, Alabama, Florida, North Carolina, Texas and Oklahoma.

Monthly mean flows remained in the above-normal range in parts of Wisconsin, Michigan, the New England States, Montana, Quebec, British Columbia and increased into that range in parts of Idaho and Arizona. Flows were in the below-normal range in Minnesota and many east-central States. Drought conditions prevailed in California.

Flooding occurred in Georgia, North Carolina, Texas and Oklahama. Monthly or daily mean discharges were lowest of record for the month in parts of South Dakota and Ohio and highest of record for the month in parts of Montana and Alabama.



CONTENTS OF THIS ISSUE: Northeast, Southeast, Western Great Lakes region, Midcontinent, West; Usable contents of selected reservoirs near end of May 1976; Publications on techniques of water-resources investigations; Dissolved solids and water temperatures for May at downstream sites on six large rivers; Flow of large rivers during May 1976; Summary appraisals at the nation's Ground-water resources–California region.

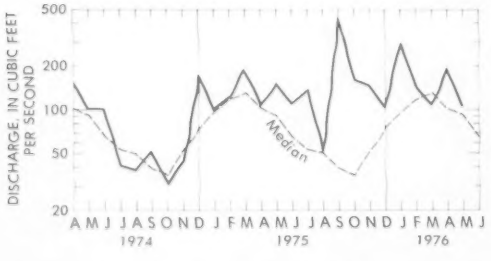
NORTHEAST

[Atlantic Provinces and Quebec; Delaware, Maryland, New York, New Jersey, Pennsylvania, and the New England States]

STREAMFLOW DECREASED SEASONALLY IN MOST OF THE REGION. EXCEPTIONS INCLUDED INCREASED FLOWS ON SOME STREAMS IN CONNECTICUT AND NEW YORK. FLOWS WERE AGAIN ABOVE THE NORMAL RANGE IN PARTS OF QUEBEC PROVINCE, NEW YORK STATE, NEW HAMPSHIRE, AND VERMONT. FLOWS CONTINUED IN THE BELOW-NORMAL RANGE IN MUCH OF PENNSYLVANIA.

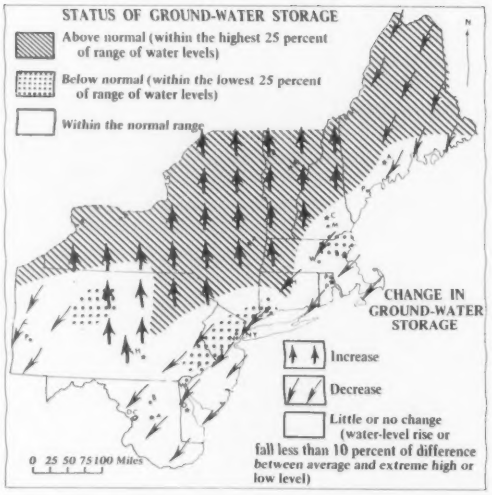
The general streamflow pattern of April continued in May: Higher-than-normal flows in the northern part of the region and below normal in much of the southern part. Some streams in Quebec and the Atlantic Provinces and in New York had about twice their normal flow for May, including Lepreau River (at Lepreau, New Brunswick), La Have River (at West Northfield, Nova Scotia), Outardes River (at Outardes Falls, Quebec), St. Francois River (at Hemmings Falls, Quebec), and West Branch Oswegatchie River (near Harrisville, N.Y.). In contrast to these high flows, the flow of Northeast Margaree River at Margaree Valley, in extreme northern Nova Scotia, was only about 60 percent of normal (because of light precipitation and low snowmelt runoff) and at monthend was at or near the lowest daily flow for May in 60 years of record.

Typical of the more common situation was the seasonal decrease that occurred in Seneca Creek at Dawsonville, Maryland. (See graph.)



Monthly mean discharge of Seneca Creek at Dawsonville, Md. (Drainage area, 101 sq mi; 262 sq km)

Ground-water levels rose in the central part of the region as well as in most of New Hampshire, Vermont, and adjacent northwestern New York State. (See map.) Levels declined in eastern and central parts of Maine, in western Pennsylvania, and in a wide coastal area from Massachusetts southwestward through eastern and central Maryland, including most of New Jersey and Connecticut. Levels declined only slightly on Long Island, N.Y. Levels near monthend were above average in northern areas of the region, including nearly all of Maine, New Hampshire, Vermont, and New York. Below-average levels persisted in several smaller areas, including parts of central and southeastern Pennsylvania, northern New Jersey, southwestern Connecticut, and northeastern Massachusetts.


STATUS OF GROUND-WATER STORAGE
Above normal (within the highest 25 percent of range of water levels)
Below normal (within the lowest 25 percent of range of water levels)
Within the normal range
N
CHANGE IN GROUND-WATER STORAGE
Increase
Decrease
Little or no change (water-level rise or fall less than 10 percent of difference between average and extreme high or low level)
0 25 50 75 100 Miles

Map shows ground-water storage near end of May and change in ground-water storage from end of April to end of May.

SOUTHEAST

[Alabama, Florida, Georgia, Kentucky, Mississippi, North Carolina, South Carolina, Tennessee, Virginia, and West Virginia]

LOCALLY SEVERE FLOODING OCCURRED AT MIDMONTH IN WESTERN NORTH CAROLINA AND NEAR MONTHEND IN NORTHEASTERN GEORGIA. IN THE REGION AS A WHOLE, STREAMFLOW DECREASED SEASONALLY IN MOST OF GEORGIA, MISSISSIPPI, TENNESSEE, KENTUCKY, VIRGINIA, AND WEST VIRGINIA; AND INCREASED IN ALABAMA, FLORIDA, AND NORTH CAROLINA. FLOWS IN THE ABOVE-NORMAL RANGE CHARACTERIZED MOST OF ALABAMA AND ADJOINING WESTERN AND NORTHERN GEORGIA, WHEREAS FLOWS CONTINUED TO BE BELOW NORMAL IN MOST OF KENTUCKY AND WEST VIRGINIA.

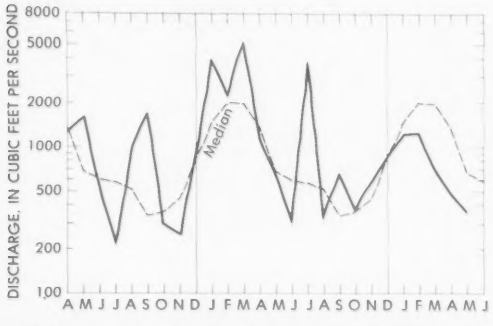
In the Tennessee River basin in mountain areas of western North Carolina, heavy rains of up to 12 inches on the 14th and 15th caused flash flooding. Areas most

affected were along Pigeon, Cullasaja, and Tuckasegee Rivers, with damages to crops and land reportedly in excess of half a million dollars.

In northeastern Georgia, north of Athens, rains of up to 8 inches on May 28–29 caused very high flows on some small streams in three or four counties near the headwaters of the Savannah and Oconee Rivers. For example, preliminary data for Hudson River at Homer (drainage area, 61.1 square miles) indicated a peak discharge of 8,200 cfs on May 29; and for Allen Creek at Talmo (drainage area, 17.3 square miles), a peak discharge of 4,500 cfs. These flows are equal to or greater than those likely to occur on the average of only once in 50 years at these measurement sites. To the west, in north-central Alabama, the monthly mean discharge at the index stream-gaging station, Cahaba River at Centreville, was more than 4,200 cfs, highest for May in the 44 years of record.

Streamflow was also far above normal for the month in northern Florida. Flow of Ochlockonee River was more than 5 times the normal rate near the end of the month, in response to heavy rainfall. In the northwestern part of the State, the monthly mean flow of Shoal River was 3 times the normal rate. Streamflow was below normal in the east-central part of the State. In the north, the discharge of Silver Springs decreased 55 cfs, to 640 cfs; remaining at 85 percent of normal. In the southeastern part of the State, at Miami, there continued to be no flow southward through the Tamiami Canal outlets, 40-mile bend to Monroe; but Miami Canal at 36th Street increased to 71 cfs, 169 percent of normal.

Flows remained relatively low in much of Kentucky and all of West Virginia, as well as in part of eastern North Carolina. Daily discharge of Neuse River near Clayton, N.C., near end of month, was about equal to the previous lowest May flows during the 49-year period of record—200 cfs. Monthly flow of Neuse River has been below median for five months, and was less than half the median flow for May. (See graph.)



Monthly mean discharge of Neuse River near Clayton, N.C. (Drainage area, 1,140 sq mi; 2,953 sq km)

Ground-water levels declined in most of West Virginia, North Carolina, and Mississippi, and declined slightly in the Piedmont of Georgia. In coastal Georgia, levels declined also in and near the centers of pumpage at Brunswick and Savannah. Levels rose in Alabama and southeastern Florida, and rose at least slightly in most of Kentucky and northern Florida. Monthend levels were generally above average in Kentucky, and in western parts of West Virginia and North Carolina; and were near or above average in southeastern Florida. Levels were below average in central and eastern parts of West Virginia and North Carolina, and in northern Florida.

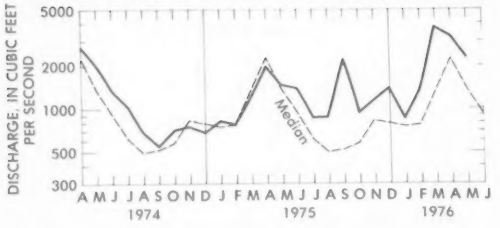
WESTERN GREAT LAKES REGION

[Ontario; Illinois, Indiana, Michigan, Minnesota, Ohio and Wisconsin]

STREAMFLOW DECREASED IN NEARLY THE ENTIRE REGION. FLOWS WERE BELOW THE NORMAL RANGE IN LARGE AREAS IN THE NORTH AND SOUTH, INCLUDING MINNESOTA ALMOST STATEWIDE, AND THE SOUTHERN TWO-THIRDS OF INDIANA AND OHIO. FLOWS CONTINUED OR MOVED INTO THE ABOVE-NORMAL RANGE IN LARGE PARTS OF MICHIGAN AND WISCONSIN. LOCAL FLOODING OCCURRED EARLY IN THE MONTH IN THE CHICAGO METROPOLITAN AREA.

Streamflow was unusually low for May in many parts of the region, in large measure a result of below-average precipitation during the month. Flows during April had been low in Indiana and Ohio. Monthly mean discharge of Scioto River at Higby, Ohio (drainage area, 5,131 square miles) was only 14 percent of median and was close to the lowest May monthly discharge in the 45 years of record (809 cfs in 1941). Other index gaging stations that had flows of less than 40 percent of May medians were Sangamon River at Monticello in east-central Illinois, Mississinewa River at Marion in east-central Indiana, Little Beaver Creek near East Liverpool in eastern Ohio, Jump River at Sheldon in northwestern Wisconsin, and Buffalo River at Dilworth in northwestern Minnesota. The unusually dry weather in Minnesota was also reflected in the low flow of the Mississippi River at St. Paul (drainage area, 36,800 square miles): 6,580 cfs, only 31 percent of normal for May.

Contrasting with these low-flow conditions were the above-normal discharges of many streams in southeastern Wisconsin and in Michigan's Lower Peninsula. In the northern part of the peninsula, flows of some streams have been above median, sometimes far above, for more than a year. (See graph of Muskegon River at Evart on page 4.)



Monthly mean discharge of Muskegon River at Evart, Mich. (Drainage area, 1,450 sq mi; 3,760 sq km)

Ground-water levels generally declined. However, levels continued to rise in many wells in Wisconsin. Monthend levels were below average in Minnesota and Ohio; near average in Indiana; near or above average in Wisconsin; above average in Michigan (far above in some parts of the Lower Peninsula). In Minnesota, levels continued to decline in the heavily pumped, Prairie du Chien-Jordan artesian aquifer, and started to decline in the deeper Mt. Simon-Hinckley aquifer.

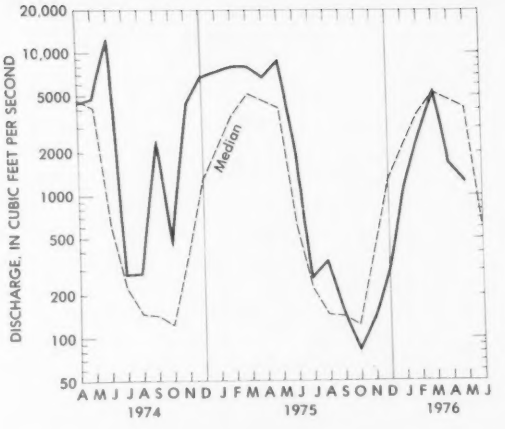
MIDCONTINENT

[Manitoba and Saskatchewan; Arkansas, Iowa, Kansas, Louisiana, Missouri, Nebraska, North Dakota, Oklahoma, South Dakota, and Texas]

NEAR-NORMAL STREAMFLOW CONDITIONS PREVAILED IN MOST OF THE REGION. FLOWS GENERALLY DECREASED SEASONALLY IN NORTHERN AND CENTRAL AREAS, BUT INCREASED IN PARTS OF TEXAS, LOUISIANA, OKLAHOMA, AND KANSAS. FLOWS DROPPED INTO THE NORMAL RANGE IN PARTS OF TEXAS, NEBRASKA, IOWA, AND MISSOURI. BELOW-NORMAL FLOWS PERSISTED IN PARTS OF ARKANSAS, MISSOURI, AND SOUTH DAKOTA, AND DECREASED INTO THAT RANGE IN EASTERN NORTH DAKOTA.

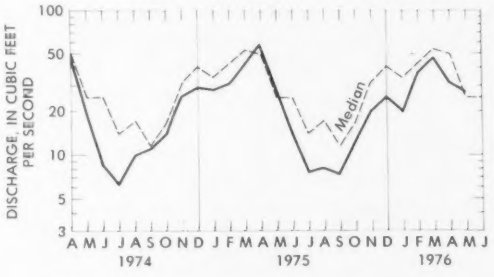
Flash flooding occurred in many small local areas in Texas and Oklahoma but only moderate rises occurred at most stream-gaging stations. For example, monthly mean discharge at Washita River near Durwood, Okla., was 62 percent of median and in the normal range. Flash flooding in Tulsa, Okla., at monthend caused a reported $12 million in damages as nearly 2,000 homes were flooded.

In adjacent Arkansas, northern Louisiana, and southeast Missouri, streamflow continued to be in the below-normal range. Typical of the streams in that area is Saline River near Rye, Ark., where the monthly mean discharge was below median and in the below-normal range for the 2d consecutive month. (See graph.)



Monthly mean discharge of Saline River near Rye, Ark. (Drainage area, 2,062 sq mi; 5,340 sq km)

In the central part of the region, monthly mean flows were generally in the normal range. Monthly mean discharge of Niobrara River above Box Butte Reservoir, Nebr., decreased seasonally but increased from the below-normal range into the normal range. (See graph.)



Monthly mean discharge of Niobrara River above Box Butte Reservoir, Nebr. (Drainage area, 1,400 sq mi; 3,630 sq km)

In South Dakota, monthly mean discharge of Bad River near Fort Pierre decreased to .01 percent of median and recorded the lowest monthly mean discharge for May since records began in 1928. In adjacent northwest Iowa, flow at the index stations——Big Sioux River at Akron and Des Moines River at Fort Dodge——decreased into the below-normal range and were 40 percent of median.

Reflecting the dry conditions in eastern North Dakota and western Minnesota, flow at the index station, Red River of the North at Grand Forks, N. Dak., decreased into the below-normal range for the first time since July 1973 and was less than 60 percent of median.

Ground-water levels generally rose in Kansas and Nebraska; and declined in Iowa and North Dakota. Monthend levels were above average in Iowa (except in

the northeastern part of the State); near average in Nebraska; and below average in North Dakota. In Arkansas, the level rose slightly in the east-central rice-growing area; and rose also in key wells at Pine Bluff and El Dorado, tapping the industrial aquifer (Sparta) in the central and southern parts of the State. In Louisiana, levels declined in the Chicot aquifer in the southwestern part of the State (reflecting pumping for rice irrigation), and declined also in the Miocene aquifer at Alexandria and in the Pleistocene aquifers in the Baton Rouge area. Elsewhere in Louisiana, levels rose in the terrace aquifer in the central part of the State, in the Sparta Sand in the north, in the "500-foot" of the Chicot aquifer in the Lake Charles area, and in the Miocene aquifers in the Baton Rouge area. Most rises were less than 1 foot. In Texas, levels rose in the Edwards Limestone at Austin and San Antonio; and declined in the Evangeline aquifer at Houston and in the bolson deposits at El Paso. Monthend levels were above average at Austin and San Antonio; and lowest of record for May at Houston and El Paso.

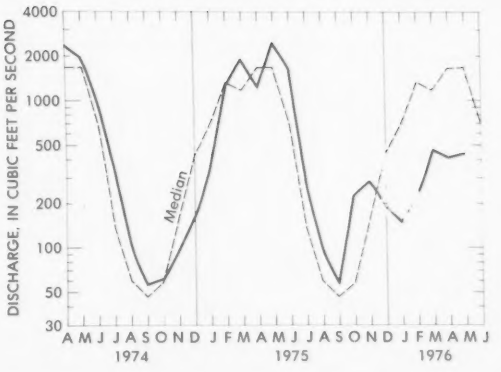
WEST

[Alberta and British Columbia; Arizona, California, Colorado, Idaho, Montana, Nevada, New Mexico, Oregon, Utah, Washington, and Wyoming]

STREAMFLOW INCREASED SEASONALLY IN ALBERTA, BRITISH COLUMBIA, IDAHO, MONTANA, WYOMING, COLORADO, UTAH, AND NEVADA; AND WAS VARIABLE ELSEWHERE IN THE REGION. FLOWS REMAINED IN THE BELOW-NORMAL RANGE IN MOST OF CALIFORNIA AND PARTS OF COLORADO AND NEW MEXICO. ABOVE-NORMAL FLOWS PERSISTED IN MUCH OF MONTANA AND INCREASED INTO THAT RANGE IN MOST OF IDAHO AND PARTS OF WASHINGTON, WYOMING AND ARIZONA.

In California, the monthly mean discharge at all reporting index stations was in the below-normal range and reflected the drought conditions that prevailed throughout the State, except where reservoir supplies were meeting the needs for irrigation, industrial, and domestic uses. Many communities are rationing the use of water as well as asking the users to be prudent in its use. Fire hazards exist in much of the wooded mountain areas and restrictions are being placed in effect. Monthly mean flow at the North Fork American River at North Fork Dam was only 26 percent of median and in the below-normal range for the fourth consecutive month. (See graph.)

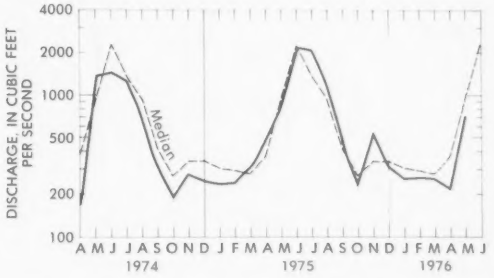
Monthly mean flows in Nevada and Utah were generally in the normal range. In north-central Utah, the



Monthly mean discharge of North Fork American River at North Fork Dam, Calif. (Drainage area, 342 sq mi; 886 sq km)

level of Great Salt Lake rose 0.15 foot during the month (to 4,202.25 feet above mean sea level), 0.90 foot higher than a year ago, and the highest level since 1928. This may be the seasonal high level for the year. The maximum level previously observed in May was 4,204.9 feet above mean sea level, in 1923.

In the adjacent State of Colorado, flow of the index station, Roaring Fork River at Glenwood Springs, was in the below-normal range, and monthly mean discharge at Arkansas River at Canon City was 75 percent of median and in the below-normal range for the 5th consecutive month. (See graph.)



Monthly mean discharge of Arkansas River at Canon City, Colo. (Drainage area, 3,117 sq mi; 2,073 sq km)

In the northern part of the region, monthly mean discharge in Clark Fork at St. Regis, in western Montana and west of the Continental Divide, increased seasonally and was in the above-normal range for the 12th consecutive month; this was the highest monthly mean discharge for May since the station was established in 1911. Similarly, flow of the Yellowstone River at Billings was in the above-normal range for the 8th consecutive month with the monthly mean discharge the highest since the station was established in 1928.

(Continued on page 8.)

USABLE CONTENTS OF SELECTED RESERVOIRS NEAR END OF MAY 1976

[Contents are expressed in percent of reservoir capacity. The usable storage capacity of each reservoir is shown in the column headed "Normal maximum."]

Reservoir Principal uses: F–Flood control I–Irrigation M–Municipal P–Power R–Recreation W–Industrial	End of Apr 1976	End of May 1976	End of May 1975	Average for end of May	Normal maximum
	Percent of normal maximum				
NORTHEAST REGION					
NOVA SCOTIA					
Rossignol, Mulgrave, Falls Lake, St. Margaret's Bay, Black, and Ponhook Reservoirs (P)	86	92	72	77	223,400 (a)
QUEBEC					
Allard (P)	94	94	83	87	280,600 ac-ft
Gouin (P)	64	78	68	59	6,954,000 ac-ft
MAINE					
Seven reservoir systems (MP)	97	100	90	89	178,500 mcf
NEW HAMPSHIRE					
First Connecticut Lake (P)	80	92	76	86	3,330 mcf
Lake Francis (FPR)	67	96	66	81	4,326 mcf
Lake Winnipesaukee (PR)	92	107	93	101	7,200 mcf
VERMONT					
Harriman (P)	92	84	88	87	5,060 mcf
Somerset (P)	79	93	89	86	2,500 mcf
MASSACHUSETTS					
Cobble Mountain and Borden Brook (MP)	85	90	91	90	3,394 mcf
NEW YORK					
Great Sacandaga Lake (FPR)	100	100	97	98	34,270 mcf
Indian Lake (FMP)	88	106	106	104	4,500 mcf
New York City reservoir system (MW)	99	100	100	.....	547,500 mg
NEW JERSEY					
Wanaque (M)	98	100	100	94	27,730 mg
PENNSYLVANIA					
Allegheny (FPR)	.....	51	.....	.....	51,400 mcf
Pymatuning (FMR)	95	95	96	99	8,191 mcf
Raystown Lake (FR)	.....	135	.....	.....	16,490 mcf
Lake Wallenpaupack (PR)	72	85	87	85	6,875 mcf
MARYLAND					
Baltimore municipal system (M)	100	99	100	94	85,340 mg
SOUTHEAST REGION					
NORTH CAROLINA					
Bridgewater (Lake James) (P)	89	100	99	92	12,580 mcf
Narrows (Badin Lake) (P)	93	93	97	100	5,617 mcf
High Rock Lake (P)	72	87	96	82	10,230 mcf
SOUTH CAROLINA					
Lake Murray (P)	90	94	92	82	70,300 mcf
Lakes Marion and Moultrie (P)	86	89	96	78	81,100 mcf
SOUTH CAROLINA–GEORGIA					
Clark Hill (FP)	77	79	78	75	75,360 mcf
GEORGIA					
Burton (PR)	93	98	95	93	104,000 ac-ft
Sinclair (MPR)	88	88	97	94	214,000 ac-ft
Lake Sidney Lanier (FMPR)	66	66	65	67	1,686,000 ac-ft
ALABAMA					
Lake Martin (P)	96	99	100	94	1,373,000 ac-ft
TENNESSEE VALLEY					
Clinch Projects: Norris and Melton Hill Lakes (FPR)	58	59	76	66	1,156,000 cfsd
Douglas Lake (FPR)	49	66	79	70	703,100 cfsd
Hiwassee Projects: Chatuge, Nottely, Hiwassee, Apalachia, Blue Ridge, Ocoee 3, and Parksville Lakes (FPR)	75	92	86	83	510,300 cfsd
Holston Projects: South Holston, Watauga, Boone, Fort Patrick Henry, and Cherokee Lakes (FPR)	61	64	84	70	1,452,000 cfsd
Little Tennessee Projects: Nantahala, Thorpe, Fontana, and Chilhowee Lakes (FPR)	73	91	84	84	745,200 cfsd
WESTERN GREAT LAKES REGION					
WISCONSIN					
Chippewa and Flambeau (PR)	98	94	96	86	15,900 mcf
Wisconsin River (21 reservoirs) (PR)	88	90	85	82	17,400 mcf
MINNESOTA					
Mississippi River headwater system (FMR)	26	24	47	38	1,640,000 ac-ft
MIDCONTINENT REGION					
NORTH DAKOTA					
Lake Sakakawea (Garrison) (FIPR)	88	89	94	.....	22,640,000 ac-ft
SOUTH DAKOTA					
Angostura (I)	74	74	86	90	127,600 ac-ft
Bell Fourche (I)	.....	73	91	73	185,200 ac-ft
Lake Francis Case (FIP)	80	77	89	83	4,834,000 ac-ft
Lake Oahe (FIP)	84	85	93	.....	22,530,000 ac-ft
MIDCONTINENT REGION–Continued					
SOUTH DAKOTA–Continued					
Lake Sharpe (FIP)	101	102	100	99	1,725,000 ac-ft
Lewis and Clarke Lake (FIP)	79	83	79	87	477,000 ac-ft
NEBRASKA					
Lake McConaughy (IP)	84	86	86	79	1,948,000 ac-ft
OKLAHOMA					
Eufaula (FPR)	106	99	108	91	2,378,000 ac-ft
Keystone (FPR)	91	97	154	115	661,000 ac-ft
Tenkiller Ferry (FPR)	123	103	106	110	628,200 ac-ft
Lake Altus (FIMR)	98	99	72	65	134,500 ac-ft
Lake O'The Cherokees (FPR)	95	96	96	92	1,492,000 ac-ft
OKLAHOMA–TEXAS					
Lake Texoma (FMPRW)	99	100	112	103	2,722,000 ac-ft
TEXAS					
Bridgeport (IMW)	86	88	79	49	386,400 ac-ft
Canyon (FMR)	99	99	100	70	385,600 ac-ft
International Amistad (FIMPW)	100	99	100	68	3,497,000 ac-ft
International Falcon (FIMPW)	86	92	89	61	2,667,000 ac-ft
Livingston (IMW)	100	100	100	76	1,788,000 ac-ft
Possum Kingdom (IMPRW)	91	93	96	106	569,400 ac-ft
Red Bluff (PI)	33	29	50	26	307,000 ac-ft
Toledo Bend (P)	92	100	100	86	4,472,000 ac-ft
Twin Buttes (FIM)	99	99	100	10	177,800 ac-ft
Lake Kemp (IMW)	77	80	57	93	268,000 ac-ft
Lake Meredith (FMW)	41	40	46	36	821,300 ac-ft
Lake Travis (FIMPRW)	95	98	100	81	1,144,000 ac-ft
THE WEST					
WASHINGTON					
Ross (PR)	35	59	34	56	1,052,000 ac-ft
Franklin D. Roosevelt Lake (IP)	7	57	12	71	5,232,000 ac-ft
Lake Chelan (PR)	53	71	48	74	676,100 ac-ft
Lake Cushman	75	92	88	96	359,500 ac-ft
Lake Merwin (P)	102	103	105	103	246,000 ac-ft
IDAHO					
Boise River (4 reservoirs) (FIP)	76	86	56	82	1,235,000 ac-ft
Coeur d'Alene Lake (P)	102	165	155	124	238,500 ac-ft
Pend Oreille Lake (FP)	51	93	65	81	1,561,000 ac-ft
IDAHO–WYOMING					
Upper Snake River (9 reservoirs) (MP)	54	65	60	73	4,689,000 ac-ft
WYOMING					
Boysen (FIP)	52	51	65	64	802,000 ac-ft
Buffalo Bill (IP)	43	52	48	75	421,300 ac-ft
Keyhole (F)	70	70	78	44	199,900 ac-ft
Pathfinder, Seminoe, Alcova, Kortes, Glendo, and Guernsey Reservoirs (I)	71	74	73	55	3,056,000 ac-ft
COLORADO					
John Martin (FIR)	0	0	0	15	364,400 ac-ft
Taylor Park (IR)	55	63	58	74	106,200 ac-ft
Colorado–Big Thompson project (I)	71	73	73	64	722,600 ac-ft
COLORADO RIVER STORAGE PROJECT					
Lake Powell; Flaming Gorge, Navajo, and Blue Mesa Reservoirs (IFPR)	79	81	74	.....	31,280,000 ac-ft
UTAH–IDAHO					
Bear Lake (IPR)	80	90	84	67	1,421,000 ac-ft
CALIFORNIA					
Folsom (FIP)	63	64	84	91	1,000,000 ac-ft
Hetch Hetchy (MP)	.....	57	49	70	360,400 ac-ft
Isabella (FIR)	28	31	50	42	551,800 ac-ft
Pine Flat (FI)	54	57	72	72	1,014,000 ac-ft
Clair Engle Lake (Lewiston) (P)	80	86	96	96	2,438,000 ac-ft
Lake Almanor (P)	56	58	94	62	1,036,000 ac-ft
Lake Berryessa (FIMW)	80	77	99	89	1,600,000 ac-ft
Millerton Lake (FI)	76	73	60	81	503,200 ac-ft
Shasta Lake (FIPR)	70	61	104	93	4,377,000 ac-ft
CALIFORNIA–NEVADA					
Lake Tahoe (IPR)	63	.....	78	70	744,600 ac-ft
NEVADA					
Rye Patch (I)	103	87	83	.....	157,200 ac-ft
ARIZONA–NEVADA					
Lake Mead and Lake Mohave (FIMP)	78	79	75	67	27,970,000 ac-ft
ARIZONA					
San Carlos (IP)	8	6	19	17	1,093,000 ac-ft
Salt and Verde River system (IMPR)	67	66	70	48	2,073,000 ac-ft
NEW MEXICO					
Conchas (FIR)	23	23	31	77	352,600 ac-ft
Elephant Butte and Caballo (FIPR)	25	24	21	29	2,539,000 ac-ft

[a]Thousands of kilowatt-hours

PUBLICATIONS ON TECHNIQUES OF WATER-RESOURCES INVESTIGATIONS

Thirty-one manuals by the U.S. Geological Survey have been published to date in the series on techniques describing procedures for planning and executing specialized work in water-resources investigations. The material is grouped under major subject headings ("books") and is further divided into sections and chapters. For example, Section A of Book 3 (Applications of Hydraulics) is on surface water. The chapter, the unit of publication, is limited to a narrow field of subject matter. This format permits flexibility in revision and publication as the need arises. The reports listed below are for sale (except 3-A12, which is out-of-print) by the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402, and by the U.S. Geological Survey, 1200 S. Eads St., Arlington, VA 22202. Current prices as shown below are higher for some of the manuals than the prices were at the time of the first printing. Prepayment by check or money order should be made payable to whichever organization is addressed: Superintendent of Documents or U.S. Geological Survey.

NOTE: When ordering any of these publications, please give the title, book number, chapter number, and "U.S. Geological Survey Techniques of Water-Resources Investigations."

1–D1. *Water temperature--influential factors, field measurement, and data presentation,* by H. H. Stevens Jr., J. F. Ficke, and G. F. Smoot: USGS--TWRI Book 1, Chapter D1. 1975. 65 pages. $1.60.

2–D1. *Application of surface geophysics to ground-water investigations,* by A.A.R. Zohdy, G.P. Eaton, and D.R. Mabey: USGS--TWRI Book 2, Chapter D1. 1974. 116 pages. $1.90.

2–E1. *Application of borehole geophysics to water-resources investigations,* by W.S. Keys and L.M. MacCary: USGS--TWRI Book 2, Chapter E1. 1971. 126 pages. $1.75.

3–A1. *General field and office procedures for indirect discharge measurements,* by M.A. Benson and Tate Dalrymple: USGS--TWRI Book 3, Chapter A1. 1967. 30 pages. $0.25.

3–A2. *Measurement of peak discharge by the slope-area method,* by Tate Dalrymple and M.A. Benson: USGS--TWRI Book 3, Chapter A2. 1967. 12 pages. $0.20.

3–A3. *Measurement of peak discharge at culverts by indirect methods,* by G.L. Bodhaine: USGS--TWRI Book 3, Chapter A3. 1968. 60 pages. $0.40.

3–A4. *Measurement of peak discharge at width contractions by indirect methods,* by H.F. Matthai: USGS--TWRI Book 3, Chapter A4. 1967. 44 pages. $1.00.

3–A5. *Measurement of peak discharge at dams by indirect methods,* by Harry Hulsing: USGS--TWRI Book 3, Chapter A5. 1967. 29 pages. $0.30.

3–A6. *General procedure for gaging streams,* by R.W. Carter and Jacob Davidian: USGS--TWRI Book 3, Chapter A6, 1968, 13 pages. $0.20.

3–A7. *Stage measurements at gaging stations,* by T.J. Buchanan and W.P. Somers: USGS--TWRI Book 3, Chapter A7. 1968. 28 pages. $0.45.

3–A8. *Discharge measurements at gaging stations,* by T.J. Buchanan and W.P. Somers: USGS--TWRI Book 3, Chapter A8. 1969. 65 pages. $1.25.

3–A11. *Measurement of discharge by moving-boat method,* by G.F. Smoot and C.E. Novak: USGS--TWRI Book 3, Chapter A11. 1969. 22 pages. $0.40.

3–A12. *Fluorometric procedures for dye tracing,* by J.F. Wilson, Jr.: USGS--TWRI Book 3, Chapter A12. 1968. 31 pages. [Out-of-print.]

3–B1. *Aquifer-test design, observation, and data analysis,* by R.W. Stallman: USGS--TWRI Book 3, Chapter B1. 1971. 26 pages. $0.70.

3–C1. *Fluvial sediment concepts,* by H.P. Guy: USGS--TWRI Book 3, Chapter C1. 1970. 55 pages. $0.65.

3–C2. *Field methods for measurement of fluvial sediment,* by H.P. Guy and V.W. Norman: USGS--TWRI Book 3, Chapter C2, 1970. 59 pages $0.70.

3–C3. *Computation of fluvial-sediment discharge,* by George Porterfield: USGS--TWRI Book 3, Chapter C3. 1972. 66 pages. $1.15.

4–A1. *Some statistical tools in hydrology,* by H.C. Riggs: USGS--TWRI Book 4, Chapter A1. 1968. 39 pages. $0.30.

4–A2. *Frequency curves,* by H.C. Riggs: USGS--TWRI Book 4, Chapter A2. 1968. 15 pages. $0.20.

4–B1. *Low-flow investigations,* by H.C. Riggs: USGS--TWRI Book 4, Chapter B1. 1972. 18 pages. $0.65.

4–B2. *Storage analyses for water supply,* by H.C. Riggs and C.H. Hardison: USGS––TWRI Book 4, Chapter B2. 1973. 20 pages. $0.75.

4–B3. *Regional analyses of streamflow characteristics,* by H.C. Riggs: USGS––TWRI Book 4, Chapter B3. 1973. 15 pages. $0.75.

4–D1. *Computation of rate and volume of stream depletion by wells,* by C.T. Jenkins: USGS––TWRI Book 4, Chapter D1. 1970. 17 pages. $0.65.

5–A1. *Methods for collection and analysis of water samples for dissolved minerals and gases,* by Eugene Brown, M.W. Skougstad, and M.J. Fishman: USGS––TWRI Book 5, Chapter A1. 1970. 160 pages. $2.40.

5–A2. *Determination of minor elements in water by emission spectroscopy,* by P.R. Barnett and E.C. Mallory, Jr.: USGS––TWRI Book 5, Chapter A2. 1971. 31 pages. $0.80.

5–A3. *Methods for analysis of organic substances in water,* by D.F. Goerlitz and Eugene Brown: USGS––TWRI Book 5, Chapter A3. 1972. 40 pages. $0.90.

5–A4. *Methods for collection and analysis of aquatic biological and microbiological samples,* by K.V. Slack, R.C. Averett, P.E. Greeson, and R.G. Lipscomb: USGS––TWRI Book 5, Chapter A4. 1973. 165 pages. $1.95.

5–C1. *Laboratory theory and methods for sediment analysis,* by H.P. Guy: USGS––TWRI Book 5, Chapter C1. 1969. 58 pages. $0.65.

7–C1. *A digital model for aquifer evaluation,* by G.F. Pinder: USGS––TWRI Book 7, Chapter C1. 1970. 18 pages. $0.65.

8–A1. *Methods of measuring water levels in deep wells,* by M.S. Garber and F.C. Koopman: USGS––TWRI Book 8, Chapter A1. 1968. 23 pages. $0.70.

8–B2. *Calibration and maintenance of vertical-axis type current meters,* by G.F. Smoot and C.E. Novak: USGS––TWRI Book 8, Chapter B2. 1968. 15 pages. $0.40.

(Continued from page 5.)

Flows in Idaho and eastern Washington were generally in the above-normal range. In the adjacent Province of British Columbia, monthly mean flow of Fraser River at Hope increased sharply and remained in the above-normal range for the 2d consecutive month and above median for the 7th consecutive month.

Storage in major reservoirs was generally below average in California and Washington, and above average in Idaho. The net increase in storage in the Colorado River Storage Project was 834,680 acre-feet during the month.

Ground-water levels generally rose in Montana, in north-central and east-central Nevada (Paradise and Steptoe, respectively), and at Meridian in south-central Idaho. Levels declined in most of Washington (except at Spokane) and in Utah; and changed only slightly in southern New Mexico. Monthend levels were generally above average in Washington (except at Cashmere in extreme northwest), Montana, in north-central and east-central Nevada, and in northern and southeastern Utah (Logan and Blanding, respectively). Levels were below average in southern New Mexico and most of Utah. In Idaho, levels were above average in key wells representing aquifers in the Boise Valley, Snake Plain, and Rathdrum Prairie.

ALASKA

Streamflow increased seasonally and the ice moved out of many rivers except those at higher altitudes and latitudes. However, the runoff at index stations in western Alaska was below normal because of cooler-than-normal temperatures and below-normal snow cover. The usual ice-jam floods of spring have occurred on the larger rivers, including the flooding at Bethel on the Kuskokwim River.

Ground-water levels in the Kenai area fluctuated only slightly in the confined aquifers, whereas levels rose seasonally in the unconfined aquifers. In the Anchorage area, the only significant change was the rise near the large public-supply wells where levels rose 3 to 7 feet because of reduced pumping. Levels in the unconfined system rose about half a foot.

METRIC EQUIVALENTS OF UNITS USED IN THE WATER RESOURCES REVIEW

(Round-number conversions, to nearest four significant figures)

1 foot = 0.3048 metre 1 mile = 1.609 kilometres
1 acre = 0.4047 hectare = 4,047 square metres
1 square mile (sq mi) = 259 hectares = 2.59 square kilometres (sq km)
1 acre-foot (ac-ft) = 1,233 cubic metres
1 million cubic feet (mcf) = 28,320 cubic metres
1 cubic foot per second (cfs) = 0.02832 cubic metres per second = 1.699 cubic metres per minute
1 second-foot-day (cfsd) = 2,447 cubic metres
1 million gallons (mg) = 3,785 cubic metres = 3.785 million litres
1 million gallons per day (mgd) = 694.4 gallons per minute (gpm) = 2.629 cubic metres per minute = 3,785 cubic metres per day

Provisional data; subject to revision

DISSOLVED SOLIDS AND WATER TEMPERATURES FOR MAY AT DOWNSTREAM SITES ON SIX LARGE RIVERS

Station number	Station name	May data of following calendar years	Stream discharge during month	Dissolved-solids concentration during month[a]		Dissolved-solids discharge during month[a]			Water temperature during month		
			Mean (cfs)	Minimum (mg/l)	Maximum (mg/l)	Mean	Minimum	Maximum	Mean, in °C	Minimum, in °C	Maximum, in °C
						(tons per day)					
	NORTHEAST										
01463500	Delaware River at Trenton, N.J.	1976	13,530	78	96	2,640	2,120	3,270	16.0 (61°F)	12.0 (54°F)	20.0 (68°F)
	(Morrisville, Pa.)	1945–75	14,770	50 (May 21–31, 1946)	115 (May 19, 1970)	.....	930 (May 31, 1965)	12,500 (May 31, 1968)	.....	10.0 (50°F)	28.5 (84°F)
			[14,300[b]]			.....			.....		
04264331	St. Lawrence River at Cornwall, Ontario, near	1976	328,000	166	168	148,000	139,000	153,000	8.5 (48°F)	7.0 (44°F)	9.5 (49°F)
	Massena, N.Y. (streamflow station formerly at	1966–75	272,800	.....	.....	.....	.....	.....	9.0 (48°F)	4.0 (39°F)	15.0 (59°F)
	Ogdensburg, N.Y.)		[257,000[b]]								
	SOUTHEAST										
07289000	Mississippi River at Vicksburg, Miss	1976	555,100	191	232	318,000	294,000	383,000	18.0 (64°F)	17.0 (62°F)	20.0 (68°F)
			[854,600[b]]								
	WESTERN GREAT LAKES REGION										
03612500	Ohio River at lock and dam 53, near Grand Chain, Ill.	1976	114,000	156	202	.....	25,500	108,000	.....	16.5 (62°F)	20.5 (69°F)
	(25 miles west of Paducah, Ky.; streamflow station	1955–75,	354,700	192 (May 30, 1958)	270 (May 28, 1968)	.....	49,900 (May 26, 1964)	308,000 (May 21, 1961)	.....	6.5 (44°F)	25.0 (77°F)
	at Metropolis, Ill.)		[296,500[b]]						.....		
	MIDCONTINENT										
06934500	Missouri River at Hermann, Mo. (60 miles west of St. Louis, Mo.)	1976	102,000	263	439	90,500	69,700	121,000	17.5 (64°F)	14.0 (57°F)	20.5 (69°F)
			[90,880[b]]								
	WEST										
14128910	Columbia River at Warrendale, Oreg.	1976	360,600	67	90	78,700	64,000	100,000	12.5 (54°F)	10.5 (51°F)	13.0 (56°F)
	(30 miles east of Portland, Oreg.; streamflow station	1968–73	317,000	.....	.....	.....	.....	.....	.....	9.0 (48°F)	17.0 (62°F)
	at The Dalles, Oreg.)		[334,600[b]]						.....		

[a]Dissolved-solids concentrations when not analyzed directly, are calculated on basis of measurements of specific conductance.
[b]Median of monthly values for 30-year reference period, water years 1941–70, for comparison with data for current month.

FLOW OF LARGE RIVERS DURING MAY 1976

Station number*	Stream and place of determination	Drainage area (square miles)	Mean annual discharge through September 1970 (cfs)	May 1976					
				Monthly discharge (cfs)	Percent of median monthly discharge, 1941–70	Change in discharge from previous month (percent)	Discharge near end of month		
							(cfs)	(mgd)	Date
1–0140	St. John River below Fish River at Fort Kent, Maine.	5,690	9,397	38,100	122	-28	18,000	11,600	31
1–3185	Hudson River at Hadley, N.Y	1,664	2,791	7,300	163	-37	6,800	4,390	31
1–3575	Mohawk River at Cohoes, N.Y	3,456	5,450	10,670	175	-10	.....	.....	.....
1–4635	Delaware River at Trenton, N.J	6,780	11,360	14,010	98	+5	15,300	9,890	25
1–5705	Susquehanna River at Harrisburg, Pa.	24,100	33,670	30,780	61	-18	29,000	18,700	31
1–6465	Potomac River near Washington, D.C.	11,560	[1]10,640	5,420	41	-58	6,170	3,990	31
2–1055	Cape Fear River at William O. Huske Lock near Tarheel, N.C.	4,810	4,847	2,715	86	+20	6,460	4,180	31
2–1310	Pee Dee River at Peedee, S.C	8,830	9,098	6,300	89	-6	5,850	3,780	26
2–2260	Altamaha River at Doctortown, Ga.	13,600	13,380	18,320	152	-2	30,200	19,500	26
2–3205	Suwannee River at Branford, Fla	7,740	6,775	5,810	87	+19	9,860	6,370	27
2–3580	Apalachicola River at Chattahoochee, Fla.	17,200	21,690	38,600	192	+34	47,700	30,800	28
2–4670	Tombigbee River at Demopolis lock and dam near Coatopa, Ala.	15,400	21,700	41,566	264	-28	31,800	20,500	26
2–4895	Pearl River near Bogalusa, La	6,630	8,533	8,230	83	-74	4,900	3,170	31
3–0495	Allegheny River at Natrona, Pa	11,410	[1]18,700	9,480	39	-39	6,340	4,100	27
3–0850	Monongahela River at Braddock, Pa.	7,337	[1]11,950	5,680	41	-50	5,400	3,490	27
3–1930	Kanawha River at Kanawha Falls, W.Va.	8,367	12,370	6,100	48	-31	5,140	3,320	26
3–2345	Scioto River at Higby, Ohio	5,131	4,337	813	14	-54	702	454	26
3–2945	Ohio River at Louisville, Ky[2]	91,170	110,600	42,400	32	-55	29,600	19,100	26
3–3775	Wabash River at Mount Carmel, Ill.	28,600	26,310	10,360	30	-48	7,700	4,980	31
3–4690	French Broad River below Douglas Dam, Tenn.	4,543	[1]6,528	6,884	108	0	.....	.....	.....
4–0845	Fox River at Rapide Croche Dam, near Wrightstown, Wis.[2]	6,150	4,142	6,850	145	+11	.....	.....	.....
02MC002 (4–2643.31)	St. Lawrence River at Cornwall, Ontario–near Massena, N.Y.[3]	299,000	239,100	328,500	128	+8	340,000	220,000	31
050115	St. Maurice River at Grand Mere, Quebec.	16,300	24,900	89,000	152	-7	74,200	48,000	25
5–0825	Red River of the North at Grand Forks, N. Dak.	30,100	2,439	2,556	56	-72	1,750	1,130	31
5–3300	Minnesota River near Jordan, Minn ..	16,200	3,306	1,341	26	-64	790	510	26
5–3310	Mississippi River at St. Paul, Minn ...	36,800	[1]10,230	6,583	31	-70	3,020	1,950	25
5–3655	Chippewa River at Chippewa Falls, Wis.	5,600	5,062	4,111	60	-77	.....	.....	.....
5–4070	Wisconsin River at Muscoda, Wis	10,300	8,457	13,039	123	-56	.....	.....	.....
5–4465	Rock River near Joslin, Ill	9,520	5,288	9,358	150	-9	6,200	4,010	31
5–4745	Mississippi River at Keokuk, Iowa ...	119,000	61,210	90,000	103	-42	58,300	37,700	28
5–4855	Des Moines River below Raccoon River at Des Moines, Iowa.	9,879	3,796	6,571	114	-2	12,600	8,140	27
6–2145	Yellowstone River at Billings, Mont.	11,795	6,754	24,170	186	+350	38,000	24,560	31
6–9345	Missouri River at Hermann, Mo	528,200	78,480	100,900	111	+4	67,300	43,500	26
7–2890	Mississippi River at Vicksburg, Miss.[4]	1,144,500	552,700	555,100	65	-18	545,000	352,000	31
7–3310	Washita River near Durwood, Okla ..	7,202	1,379	1,290	62	-29	955	617	24
8–3130	Rio Grande at Otowi Bridge, near San Ildefonso, N.Mex.	14,300	1,530	3,152	122	+91	.....	.....	.....
9–3150	Green River at Green River, Utah ...	40,600	6,369	14,007	99	+150	14,000	9,050	31
11–4255	Sacramento River at Verona, Calif ...	21,257	18,370	10,100	52	-11	10,900	7,040	27
13–2690	Snake River at Weiser, Idaho	69,200	17,670	38,860	154	-11	35,200	22,800	25
13–3170	Salmon River at White Bird, Idaho ..	13,550	11,060	51,110	161	+279	61,200	39,600	25
13–3425	Clearwater River at Spalding, Idaho ..	9,570	15,320	52,390	102	+59	50,000	32,300	25
14–1057	Columbia River at The Dalles, Oreg.[5]	237,000	194,000	360,600	108	+35	.....	.....	.....
14–1910	Willamette River at Salem, Oreg	7,280	23,370	19,840	94	-21	14,760	9,540	27-31
15–5155	Tanana River at Nenana, Alaska	25,600	24,040	24,197	75	+359	23,000	14,900	31
8MF005	Fraser River at Hope, British Columbia.	78,300	95,300	249,000	140	+210	236,000	152,500	31

[1] Adjusted.

[2] Records furnished by Corps of Engineers.

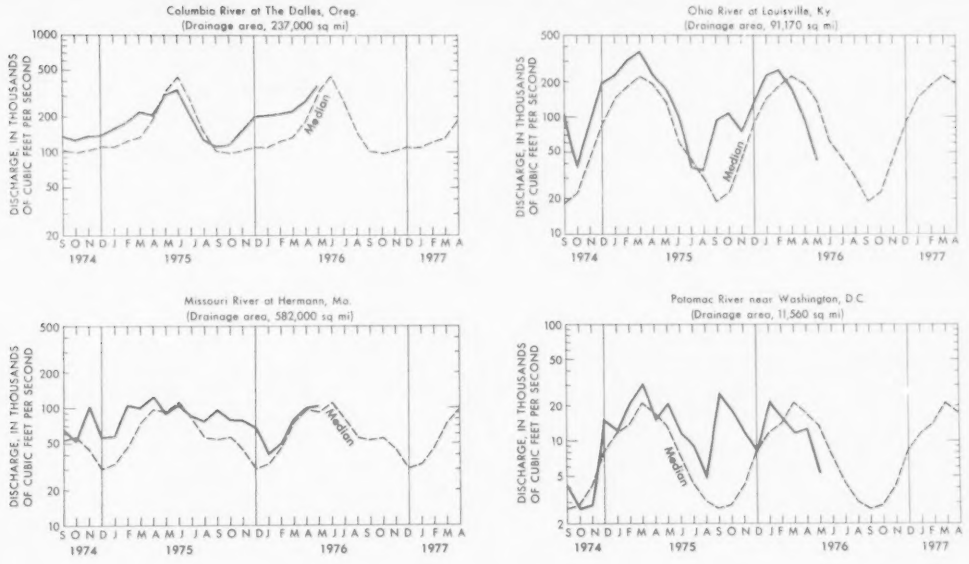
[3] Records furnished by Buffalo District, Corps of Engineers, through International St. Lawrence River Board of Control. Discharges shown are considered to be the same as discharge at Ogdensburg, N.Y. when adjusted for storage in Lake St. Lawrence.

[4] Records of daily discharge computed jointly by Corps of Engineers and Geological Survey.

[5] Discharge determined from information furnished by Bureau of Reclamation, Corps of Engineers, and Geological Survey.

*The U.S. station numbers as listed in this table are in a shortened form previously in use, and used here for simplicity of tabular and map presentation. The full, correct number contains 8 digits and no punctuation marks. For example, the correct form for station number 1–3185 is 01318500.

HYDROGRAPHS OF FOUR LARGE RIVERS


Columbia River at The Dalles, Oreg.
(Drainage area, 237,000 sq mi)
Ohio River at Louisville, Ky.
(Drainage area, 91,170 sq mi)
Missouri River at Hermann, Mo.
(Drainage area, 582,000 sq mi)
Potomac River near Washington, D.C.
(Drainage area, 11,560 sq mi)
DISCHARGE, IN THOUSANDS OF CUBIC FEET PER SECOND
Median
S O N D J F M A M J J A S O N D J F M A M J J A S O N D J F M A M J J A S O N D J F M A
1974
1975
1976
1977

WATER RESOURCES REVIEW

MAY 1976

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EXPLANATION OF DATA

Cover map shows generalized pattern of streamflow for May based on 22 index stream-gaging stations in Canada and 130 index stations in the United States. Alaska and Hawaii inset maps show streamflow only at the index gaging stations which are located near the points shown by the arrows.

Streamflow for May 1976 is compared with flow for May in the 30-year reference period 1931–60 or 1941–70. Streamflow is considered to be *below the normal range* if it is within the range of the low flows that have occurred 25 percent of the time (below the lower quartile) during the reference period. Flow for May is considered to be *above the normal range* if it is within the range of the high flows that have occurred 25 percent of the time (above the upper quartile).

Flow higher than the lower quartile but lower than the upper quartile is described as being within the *normal range*. In the Water Resources Review the median is obtained by ranking the 30 flows of the reference period in their order of magnitude; the highest flow is number 1, the lowest flow is number 30, and the average of the 15th and 16th highest flows is the median.

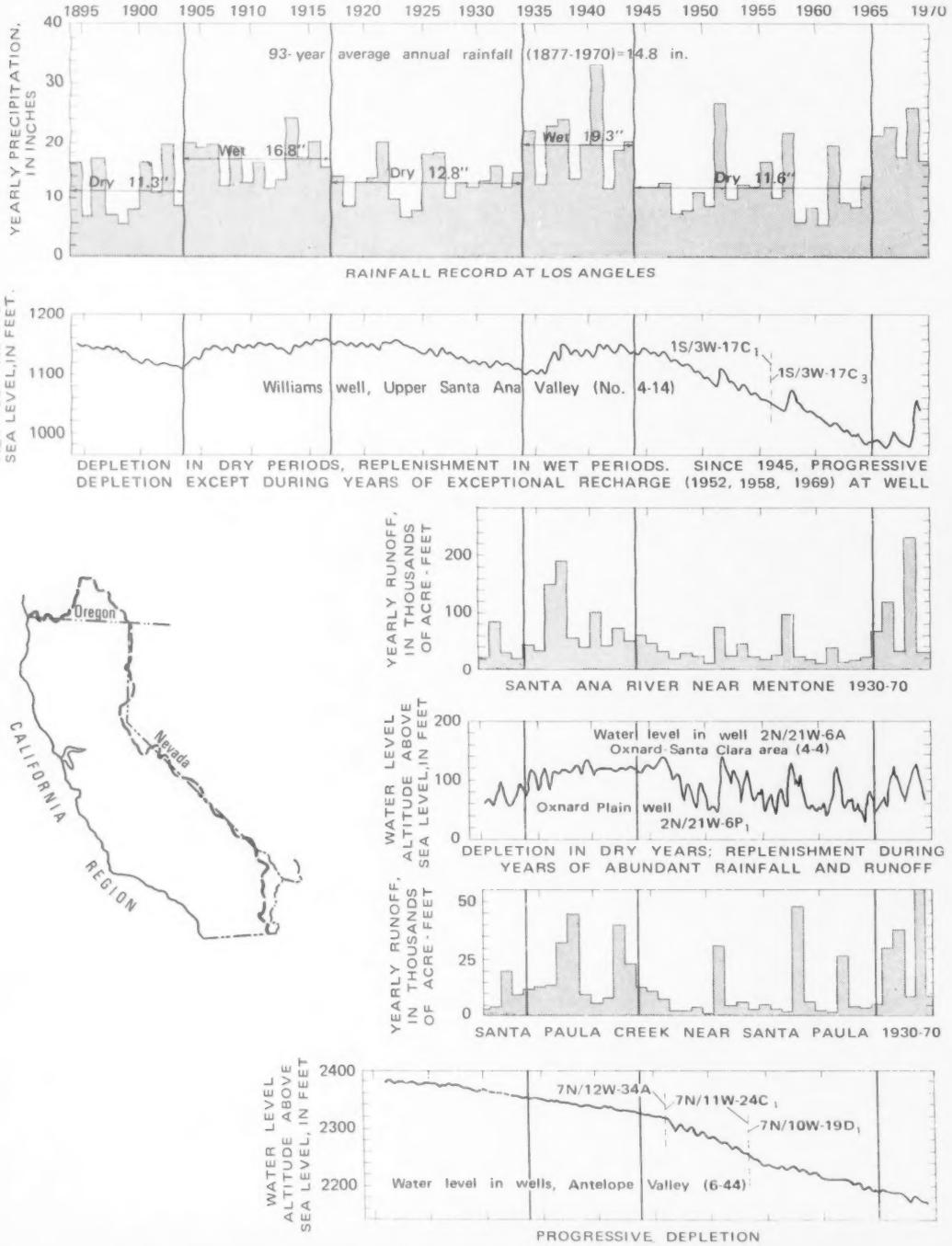
The normal is an average (but not an arithmetic average) or middle value; half of the time you would expect the May flows to be below the median and half of the time to be above the median. Shorter reference periods are used for the Alaska index stations because of the limited records available.

Statements about *ground-water levels* refer to conditions near the end of May. Water level in each key observation well is compared with average level for the end of May determined from the entire past record for that well or from a 20-year reference period, 1951–70. *Changes in ground-water levels*, unless described otherwise, are from the end of April to the end of May.

The Water Resources Review is published monthly. Special-purpose and summary issues are also published. Issues of the Review are free on application to the Water Resources Review, U.S. Geological Survey, Reston, Virginia 22092.

SUMMARY APPRAISALS OF THE NATION'S GROUND-WATER RESOURCES--CALIFORNIA REGION

The graphs below are from the report, *Summary appraisals of the Nation's ground-water resources--California Region,* by H.E. Thomas and D.A. Phoenix: U.S. Geological Survey Professional Paper 813-E, 51 pages, 1976. The report, on problems and opportunities related to the use of ground water in highly diverse hydrologic and social environments, may be purchased for $2.30 from Branch of Distribution, U.S. Geological Survey, 1200 South Eads St., Arlington, VA 22202 (check or money order payable to U.S. Geological Survey); or from Superintendent of Documents, Government Printing Office, Washington, D.C. 20402 (GPO Stock number 024-001-02769-1), payable to Superintendent of Documents.


1895 1900 1905 1910 1915 1920 1925 1930 1935 1940 1945 1950 1955 1960 1965 1970
YEARLY PRECIPITATION, IN INCHES
93-year average annual rainfall (1877-1970)=14.8 in.
Dry 11.3"
Wet 16.8"
Dry 12.8"
Wet 19.3"
Dry 11.6"
RAINFALL RECORD AT LOS ANGELES
WATER LEVEL ALTITUDE ABOVE SEA LEVEL, IN FEET
Williams well, Upper Santa Ana Valley (No. 4-14)
1S/3W-17C1
1S/3W-17C3
DEPLETION IN DRY PERIODS, REPLENISHMENT IN WET PERIODS. SINCE 1945, PROGRESSIVE DEPLETION EXCEPT DURING YEARS OF EXCEPTIONAL RECHARGE (1952, 1958, 1969) AT WELL
Oregon
Nevada
CALIFORNIA REGION
YEARLY RUNOFF, IN THOUSANDS OF ACRE-FEET
SANTA ANA RIVER NEAR MENTONE 1930-70
Water level in well 2N/21W-6A Oxnard-Santa Clara area (4-4)
Oxnard Plain well 2N/21W-6P1
DEPLETION IN DRY YEARS; REPLENISHMENT DURING YEARS OF ABUNDANT RAINFALL AND RUNOFF
SANTA PAULA CREEK NEAR SANTA PAULA 1930-70
7N/12W-34A
7N/11W-24C1
7N/10W-19D1
Water level in wells, Antelope Valley (6-44)
PROGRESSIVE DEPLETION

Effects of pumping and recharge on water levels in wells in southern California.

INT: 5441-76